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AGRICULTURAL DEVELOPMENT.

The work of the Departments of Agriculture and the Research Stations.

THE Imperial Agricultural Research Conference which met recently in the United Kingdom had under consideration means by which agricultural development could be stimulated and maintained throughout the Empire, and carefully investigated the programmes for establishing closer co-operation between agriculturists, the setting up of additional Research Stations in tropical and sub-tropical countries, the creation of Imperial Bureaux, and the recruitment, training and interchange of research workers. The advisability of establishing a chain of research stations, of which the Imperial College of Tropical Agriculture, Trinidad, forms the first, and Amani, Tanganyika, the second link was given a good deal of careful attention. The admirable work of the local Departments of Agriculture within their respective spheres was fully appreciated, but it was recognised that there was room for another type of institution, which, free from the routine and administrative work created by local demands, could further the progress of agricultural science and supplement the activities of the Departments. The work of this institution, the Research Station, will be that of initiating and fostering long-range research. Of course, much important research work is already carried on by the Departments, but in most cases it is impossible to divert energy from the many pressing local problems, and difficult to secure the continuity of work and the specialised equipment that is necessary for the successful solution of the more fundamental agricultural problems. The work of the Research Stations, then, lies in a different sphere from that of the Departments, and concentrating as they will be on research and ultimate, as opposed to immediate results, they cannot in any way be regarded as substitutes for the existing Departments of Agriculture in their territories. On this point the conclusions of the Conference are most emphatic. To quote their report—"The Conference desire to emphasize the importance of preventing the establishment of a central Research Station from being allowed to impair or replace the scientific work properly undertaken by the Agricultural Department of any Government in its proximity. They conceive the work of such stations as a reinforcement of the Agricultural Departments, and in no sense as a substitute for their work. The work undertaken by a central Research Station will from time

to time enable it to afford valuable advice to Agricultural Departments in its neighbourhood, but they do not consider it should be regarded as a function of a central station as such to provide such advice, except as the direct result of its research activities. This conclusion, however, should not be taken as debarring a central station in special conditions such as those of the West Indies, from being treated as a convenient base of operations for a travelling advisory staff." The need for the retention of the Departments in areas where the Research Stations are located is strongly advocated by all competent to speak. Mr. Ormsby-Gore, the Under-Secretary for the Colonies, when taking the Chair at the lecture on "The Producer in the Caribbean Colonies," said, "The West Indies group was fortunate in that the first big centre for purely tropical research work had been established in Trinidad. But Trinidad would make the mistake of its life if, because the Imperial College was there, it let down its own Agricultural Department." Although the Research Stations would be normally concerned with research, it does not follow that they will be of less use to the agricultural community. Indeed, by confining themselves to the scientific aspects of agricultural work, they will be all the more helpful. In Trinidad the Froghopper has proved a very serious pest on the sugar-cane and the treatment of the problem called for more elaborate and continuous work than the Department of Agriculture could devote to it. It needed the attention of specialists in the different agricultural sciences and the local Department, with pressing work of other crops and other pests, could not second its specialist officers to this one problem. Investigations, the lines for which are laid down by agricultural scientists, are now being carried out with the co-operation of the Agricultural Department and the estates on the Island. Entomologists and others have dealt with the position in their particular point of view. Now a solution is thought to lie in the condition of the soil and it has been shown that control can be effected to some degree by means of spraying. The local Agricultural Department would never have had the time to devote to the extensive laboratory work which was necessary before these helpful conclusions were arrived at. Amongst the research stations, the Imperial College holds a special position in that it is contemplated as the only teaching institution and as the place through which agricultural and specialist officers will pass before being appointed to Colonial Departments of Agriculture. In addition, it is the centre for the Imperial Department of Agriculture for the West Indies. This latter function arises for historical reasons. At the time of the inception of the College, the staff of the old Imperial Department became the staff of the College. This connection with the Imperial Department gives the College the advantage of being kept closely in touch with the major agricultural problems arising in the West Indies, while at the same time it provides the Islands with a consulting centre when specific troubles occur too difficult for the local Agricultural Department to deal with unaided. It is contemplated that the other Research Stations will also have their special features.

POULTRY ON THE FARM.

FARMING has been altered in many respects since the war, and poultry once considered as the scavengers of the farm are frequently regared now as one of the principal sources of income. With regard to cereals, meat and fruit, England cannot be self-supporting, owing to the cheaper production over seas, but with eggs the foreigner has no advantage. Since twenty million pounds worth of poultry products are imported into England every year, it is obvious that there is large scope and ready market for the development of the egg industry at home.

Dr. Ruston, the Agricultural Economist at Leeds, working on from 14 to 25 farms of various types, found that apart from poultry, the profits or losses made by these farms were as follows :—

1921-22	..	.. loss 18	per cent.
1922-23	..	.. loss 7	do.
1923-24	..	profit 3½	do.
1924-25	..	profit 5	do.

But throughout this period poultry showed a steady consistent profit. In 1921, a boom year for poultry, the average profit was 14*s.* 2*d.* per bird, and in 1922, 1923, 1924 and 1925 the average profits per bird were 9*s.* 9*d.*, 3*s.*, 3*s.* 10*d.* and 4*s.* 6*d.* respectively. The 1925 figure was obtained from 26 farms carrying a total of 3,655 birds.

Dr. Ruston has given us an interesting note on the relative profits obtained from the dairy cows and poultry on one farm of 80 acres. Here the owner kept 15 cows and 750 hens, and the returns show that every 37 hens gave the same profit as one cow. Owing to the smaller capital involved, hens yielded 47 per cent. profit and the cows 19 per cent. profit. On many farms running 1,000-5,000 well bred laying hens, farmers do not hesitate to say that they are making more profit from poultry than from cows.

The requisites essential for success in poultry farming are firstly, suitable stock, and secondly, good management. Neither good stock nor good management alone will insure a profit. It costs as much or nearly as much, to breed, rear, and house a hen which only lays 70 eggs a year as it does to keep one laying twice that number. Yet the number laid will make the difference between a profit or a loss. Some hens have laid 300 eggs and over, but this is not of much value to the ordinary farmer. What is important is the average egg production year after year. During the last 25 years egg production per bird has probably increased by about 25 per cent., and a much larger increase could be obtained with comparatively little effort. No farmer should be content with less than an average of 150 eggs a year from his pullets.

IMPERIAL AGRICULTURAL RESEARCH CONFERENCE.

Report of the Administrative Commission.

THE report of the Administrative Commission to the Imperial Agricultural Research Conference deals in the first place with the proposed chain of tropical and sub-tropical Research Stations. It is rightly pointed out that since so large a part of the tropical and sub-tropical areas of the British Empire lies within the Colonial Empire, the majority of the stations proposed must eventually be looked for in Colonial territories. It is gratifying to note, therefore, that the scheme has been spontaneously approved by the representatives of the Dominions, since it emphasizes the fact that the problem is at last being tackled on a broad basis and that it is now realised that the proper development of the tropical areas by the application of scientific research in agriculture, is also of vital importance to the prosperity of those portions of His Majesty's possessions that lie outside the tropics. The highly developed industrial areas of the cooler regions of the globe are becoming more and more dependent on the tropics for their supplies of raw materials. Compared with the tropics, of course, the temperate regions are comparatively richly equipped with research facilities and if one glances down the list of agricultural research workers that was tabulated and placed before the Conference, one cannot help being greatly struck by the great disparity in numbers that actually exists between those engaged in the tropics and those working in the temperate regions. It is obvious that the potentialities of the tropics, so far as agricultural research is concerned, have not yet been more than superficially explored.

The scheme for the development of agricultural research in the tropics was brought forward by the Imperial Conference in 1926 and by the Colonial Office Conference of 1927, and the report now under review endorses the main conclusions previously arrived at, although several important elaborations have been made. In the first place it is pointed out that any definite extension of the programme to include further stations in the self-governing Dominions must be a matter for further consideration for the Governments concerned. On the other hand the programme for the establishment of new stations in the Colonial Empire should rest primarily with the Colonial Agricultural Council it is proposed to set up.

This Conference has done a great deal to clear the air and prevent misconception, by laying down definite proposals regarding the scope and functions of the Research Stations. With regard to the locations of these stations, the original idea that such a station should be established in accordance with geographical or political consideration has now been abandoned; the site for a new station will in future be decided upon after ascertaining the needs of Empire research in a particular field of agriculture, and it is to be located in a territory selected because it affords specially advantageous conditions for the study of that particular line of research. This principle has generally been adopted in the past, but there was a distinct danger that it might not be adhered to in the future. Malaya naturally was the area selected for research work on rubber, and Ceylon for tea and the establishment of Research Stations to study these two important crops is obviously justified. Certain considerations apart from financial ones, caused Trinidad to be selected as the site for the Imperial College of Tropical Agriculture, an Institution, which it is gathered, is to come within the aegis of the new scheme. This Island on account of its easy accessibility, equable climate, reliable rainfall, and freedom from hurricanes is admirably situated for work on certain important tropical crops. The West Indian area as a whole, produces a large proportion of the world's sugar-cane and it is natural, therefore, that sugar should figure largely in the research programme of the Imperial College, more especially if it is remembered that the very existence of several of the British Colonies in the West Indies depends on this crop. Another line of obvious research lies in the direction of tropical fruit, particularly bananas and the problems connected with their production, transport and marketing. The trade in bananas has now assumed vast proportions and special services of steamers have been organised to deal with the crop. The crop is obviously of great importance, not only to the West Indies, but also to the consuming population in the temperate zone. The problems connected with the successful cultivation of this crop more especially in the direction of combating serious maladies, such as the Panama disease, are, therefore, the subject of research at this College. A further development has necessitated a study of the conditions under which the fruit is transported to the overseas markets and the College authorities have recently received financial assistance from the Empire Marketing Board which will enable them to establish a Low Temperature Research Station to deal with tropical fruits and particularly bananas.

Another recommendation of the Administrative Commission in their report suggests lines of demarcation between the functions of a Research Station and those of a Colonial Agricultural Department. It is definitely laid down that the work of these stations must be considered as a reinforcement of an Agricultural Department, but in no sense a substitute for its work. The Conference further emphasized the importance of preventing the establishment of a Central Research Station from being allowed to replace

the scientific work of an Agricultural Department in its proximity. It is maintained that the stations should confine themselves to "long range" and "wide range" research. They should concentrate on problems requiring more prolonged research than can usually be expected of a Colonial Agricultural Department or on problems that arise in more than one territory of the Empire. This warning is timely, as there has been a distinct tendency to regard the establishment of a Research Station as an easy means of cutting down the staff and finances of a local Agricultural Department with an inevitable curtailment of its efficiency and activity.

As regards the staff of a Research Station the committee, it is glad to record, have pointed out that conditions in the tropics necessitate the employment of additional staff. For climatic and other reasons, casualties, due to sickness or leave demands, are invariably high and the recommendation that each Department of a Research Station should be manned by not less than two first rate workers, will be found by experience to be eminently sound. The financial side of the question has been touched upon and various ways of raising the necessary funds have been mentioned. It is extremely difficult to budget for a Research Station as so much depends on the programme of work and on the locality, but the recommendation of the Conference that the establishment of a station should be postponed if the minimum requirements as regards staff and finance are not definitely forthcoming, will meet with the cordial approval of all who have had actual experience in the establishment of Institutions of this sort. There is nothing more disheartening to the research staff than to be hampered by lack of equipment and funds.

The second portion of the Administrative Commission's Report deals with the recruitment and training of staff. It is pointed out that there is a dearth of suitable recruits for the agricultural work in the Colonies, and it is suggested that the nature, amenities and prospects of the service are not yet widely enough known. It is also pointed out that the predominance of the physical over the biological sciences in all educational institutions, from the schools to the Universities in Great Britain, presents one of the greatest difficulties. The shortage of staff in the Agricultural Departments has come into marked prominence since the war, and has led to the initiation of the present scheme of Colonial Office Scholarships that has now been in existence for the last four or five years. That this scheme has proved a success is indicated by the recommendation that it should be extended and modified in the light of experience. Training should be normally for one year in Great Britain and one year in the tropics (*e.g.* the Imperial College of Tropical Agriculture in Trinidad), and it is pointed out that careful co-ordination in the work of the separate years should be effected without delay. This is a very important point, and is one that has been emphasized by the experience so far gained in the working of the scheme. It could be best effected by a round table conference between the individuals who are entrusted with the training of these students in the first year of the scholarship and representatives of the Imperial College. The suggestion that training should include some investigational work is a good one and is a principle that is already practised in Trinidad. In this connection it is noted that the existing arrangement, whereby the first year is held in Great Britain and the second in Trinidad, is likely to continue to prove satisfactory, but that variations may be necessary in certain cases. It is suggested that in certain cases more especially in connection with men who are being trained as specialists in certain branches, that both years might, with advantage, be spent in Trinidad, or at any rate a period of about eighteen months. At present the scholarship holder arrives in Trinidad in October and has usually only three or four months of crop season before him. The agricultural year, in reality, commences in Trinidad with the breaking up of the dry season at the end of May, and it is obvious that if a man is to undertake a piece of investigation as part of his training that he should see at least one whole season through. This is a suggestion that requires going into further.

The proposed division of an Agricultural Department into two separate sections, is a matter that is bound to lead to controversy. It is now proposed to call the men who are recruited for field and administrative work "agricultural officers" and the others who are engaged in research "specialist officers." One cannot help thinking that this nomenclature is unfortunate. Both are Agricultural officers, and it would possibly lead to less misunderstanding and heart burning in the future, if the officers posted to the two branches were to be termed Agricultural officer, Field section and Research section respectively. It is to be hoped in any case that this differentiation will not be too literally interpreted, as otherwise it may lead to violent dissensions within an Agricultural Department. There should be no distinction made between the two branches as regards grade and salaries if it can possibly be avoided. The "specialist" may be more highly trained in a particular branch, but he will have to rely on the experience and goodwill of the administrative officer if his work is to be conducted on sound lines and if his results are to be of economic or practical value to the Colony that is employing him. The agricultural researcher must always keep the ultimate economic issue before him. If he does not do so, he will sometimes be inclined to go off at a tangent and pursue an investigation that may be of great academic interest, but of little economic value, and at present and for years to come the latter class of problem must of necessity be tackled first and will need all the workers available. While there is undoubtedly a dearth of trained men

in some of the sciences related to agriculture, it must be remembered that there is an even greater dearth of really sound agronomists in the tropics. The tendency in the last few years has been to rely too much on the specialist to man the Agricultural Departments. The Harley Street specialist is necessary, but the health of a country depends largely on the standard of excellence reached by its general practitioners. The Conference appear to have sensed that there was perhaps a tendency for the pendulum to swing rather too far over in the direction of the specialist. It is satisfactory to note therefore that it is definitely recommended that the specialist should consider a knowledge of agriculture as a vital requirement and that his training in this subject should be such as to generate in him an enthusiasm for "practice in agriculture." This is all to the good, and it might be added that the specialist under training should be influenced to regard the *growing* crop as his material and the field as his laboratory.

The third portion of the Administrative Commission's Report deals with the dissemination and interchange of information. It is natural as a result of the success that has attended the working of the Bureaux of Mycology and Entomology since their inception, that workers in other sciences associated with agriculture should put forward the suggestion that further Bureaux should be opened. It appears that numerous suggestions to this end were made, but the Conference came to the conclusion that in some of the more newly-born departments or branches of agricultural science the time is not yet ripe for a further development of this nature. It was decided to recommend the creation of Bureaux for Soil Science at Rothamsted, for Animal Nutrition at the Rowett Institute, Aberdeen, and for Animal Health, at London, in view of the number of workers on these subjects and the output of literature—Bureaux on a smaller scale, or, as they are now to be called, Correspondence Centres, were recommended for Animal Genetics at Edinburgh University, for Agricultural Parasitology at the London School of Tropical Medicine, for Plant Genetics at Cambridge and for Fruit Production at East Malling. The latter was selected in preference to Long Ashton, since it was considered that the Dominions and Colonies are all naturally interested in "root stocks" work.

It is interesting to note that it is proposed to locate all these new Bureaux in the British Isles. Another feature is the marked attention that is now being paid to the breeding and welfare of agricultural stock. The increase in motor traction has resulted in a large decrease in the number of horses, more especially for carriage or riding work and this no doubt has resulted in a tendency to consider that there will be less demand for veterinarians in the future. So far as the tropics are concerned, however, there is a vast field before the veterinary scientist which is likely to expand as the tropical possessions become more closely settled and developed. The present wasteful system of agriculture by hand labour cannot be allowed to continue in the African colonies and the use of the plough will undoubtedly have to be introduced as a general practice. The utilization of draught animals for the plough is at present prohibited owing to the presence of tsetse fly and to diseases of various kinds. These will need prolonged investigation before they can be tackled on a large scale.

Much of the good that has resulted from the holding of the Agricultural Research Conference of 1927 cannot be recorded in print. Most valuable results accrue from the informal discussions and friendly intercourses that takes place between the delegates from various countries. The interchange of ideas is bound to be of the greatest value and to lead to a widening of outlook and the tackling of problems from a different angle.

The decision to hold another Conference of this nature in Australia in 1932 is a useful one, but one cannot help thinking also that there is room for the holding of a smaller Conference for the Colonies alone, apart from the Dominions, at an earlier date. The Dominions, as appears from the proceedings of this Conference, will be in control and will be responsible for the location of their own Research Stations and for the training of their own Research workers. The Colonies on the other hand will be dependent on one central control for both these objects. Matters in connection with agricultural research are moving so quickly and the situation is changing so rapidly that it may be necessary to overhaul and, if necessary, modify or expand the programme as laid down by the 1927 Conference for the Colonies before the next Conference is held in Australia in 1932.

G. E.

* * *

Report of the Entomology Committee.

THIS Committee puts forward its report under five headings.

(1) Representation at the Imperial Entomological Conference in London.
(2) Desirability of periodical Conferences in Imperial centres other than London.
(3) Desirability of travelling fellowships in Entomology.
(4) Emphasizing the necessity of more attention to Biological control of Insect Pests.
(5) Emphasizing the facility offered in the Review of Applied Entomology for the publication of urgent information regarding the outbreaks of injurious pests.

The Conferences of the Entomologists of the Empire which have been arranged by the Imperial Bureau of Entomology in London have been very successful. The personal contact of workers from different localities and the opportunity of discussing their several problems make these Conferences of great value, and the necessity for

affording opportunities for adequate representations at them should be obvious. These Conferences, also, have been held at intervals of five years, and the suggestion is made that opportunities should be given for more localised Conferences of workers in Entomological Science in centres away from London. Such Conferences would be supplemental and should prove very beneficial.

Travelling Fellowships for Entomological workers would confer benefits along the same lines as the Conferences with the difference that the individual would have an opportunity of visiting the centres of entomological activity in different parts of the Empire, where important problems of investigation and research were being studied, giving an opportunity for becoming acquainted with similar problems under somewhat varying conditions, and for coming in contact with problems widely differing in character.

The Biological Control of Insect pests, particularly by means of predaceous and parasitic insects is an important matter, which at present is attracting a great deal of attention. The establishment in England of a central station which can be used as a clearing house for the enemies of insect pests is an important step in the right drection. In addition to the actual handling of such insects this station promises to become a centre for the distribution of highly specialised information and literature references to workers in all parts of the Empire. A very valuable function of such a station will be the co-operation and general advice which can be given to the entomologists working on these problems in the Dominions and Colonies, even when the problems are very specialised with regard to the locality.

Referring to the requests from the International Institute of Agriculture at Rome, it is stated that the Imperial Bureau of Entomology offers adequate facilities in the Review of Applied Entomology for the publication of urgent information with regard to the outbreak of insect pests, and suggests that the entomologists within the Empire should take advantage of these facilities.

The Report of the Entomology Committee is brief and very much to the point. Entomologists who have had experience in the Colonies realise the great benefits to be derived from contact with other workers in entomology and other agricultural sciences. Opportunities for personal contact between Entomologists are often limited, and Conferences both local and Imperial are always welcome and the facilities which would be given by the opportunity to travel for study of important problems on the spot would be considered by most entomologists a great addition to the amenities of entomological work in the Colonies.

H. A. B.

Report of the Soils and Fertilizers Committee.

THIS Report contains two sections, one devoted to the need of a Soils Bureau, and the other to details of technical procedure in soil examination and classification.

1. *An Imperial Bureau of Soils.*

The Committee indicated the need of a Soils Bureau, having the following main functions :

(1) Collection and circulation of information, whereby soil workers in different parts of the Empire could keep in touch with recent developments in Soil Science. This would require a central library, and may necessitate the publication of a special journal, in which informative notes of value to workers in different countries could be issued.

(2) Organization of soil surveys, and systematization of field and laboratory survey methods.

(3) Organization of investigations on the maintenance and improvement of soil fertility by cultivation, irrigation, and the proper use of fertilizers.

(4) Arrangements for visits by officers of the Bureau and by specialists in various branches of soil science, to countries overseas, and for interchange of soil workers between the various countries of the Empire.

(5) Organization of Soil Conferences.

It is suggested that the Bureau might be located at Rothamsted, England, and might be controlled by the Director of the Rothamsted Experimental Station. The annual cost of the upkeep of a Bureau of Soils, such as that indicated, would be about £4,000.

2. *Technical Methods.*

(*a*) *Soil Classification.*—As a working basis, a memorandum, drawn up by Professor G. W. Robinson and Dr. W. G. Ogg, might be circulated for the guidance of soil workers within the Empire.

(*b*) *Soil Analysis.*—It was thought desirable that some standard method of mechanical analysis should be established and used by soil analysts throughout the Empire. The proposed Bureau might study suggested methods, and select from them those that might be applicable for purposes of unification of analytical results.

(*c*) *Fertilizer Trials.*—It was thought necessary that certain fundamental principles should be applied in fertilizer trials throughout the Empire, with due regard, of course, to differences in growth conditions and crop types in the various countries. This would secure some degree of uniformity, and might ensure comparability of results.

(*d*) *Soil Deterioration.*—This important subject requires special investigation in various parts of the Empire where shifting cultivation, deafforestation, &c., are practised.

It is obvious to anyone who has experienced the isolation imposed by service in overseas countries, where small departments of general agriculture form the only headquarters of soil

workers, that the advantages to be gained by the establishment of a central Soils Bureau, are enormous. Not only will such an organization lead to greater individual efficiency, but also it will furnish a source of inspiration which is bound to bring its good results. At present overseas soil workers, home on leave, feel almost alienated from their colleagues in Britain. Although always considerable interest is shown in their particular problems, the feeling of direct responsibility is lacking, and complete sympathy is difficult to establish. The proposed Bureau should largely eliminate these conditions. If the agricultural resources of the Empire are to be fully developed, there is no doubt that the establishment of an efficient Bureau of Soils would be a very important factor in bringing about that end.

F. H.

* * *

Report of the Committees on Fruit, Preservation and Transport, and Plant Breeding.

THE keynote of the Fruit Committee's Report is struck in the first sentence of the official summary. "The interval between the planting of fruit trees and the time when they come into bearing is so great that the losses consequent on mistakes at an early stage are extremely serious to the horticulturist."

Precisely the same consideration applies to many tropical crops which would not be classified as fruit trees in the usual popular sense of the term, such as cacao, coconuts, and rubber, to mention only three, and the subsequent findings of the Committee have therefore even a wider interest than the title would indicate.

Some of the mistakes which have been made in the past (and, one may add, are still being made) are briefly noted.

The first is selection of unsuitable varieties. "In every fruit-growing district there are numerous instances of varieties unsuitable to local conditions."

In the second place—"In parts of the Empire, there are frequent examples of fruit plantations which are unprofitable because the variety planted turns out to be not that which the grower believed he was planting, but a rogue of very inferior value."

Thirdly, in the case of plants propagated vegetatively, by grafting or budding, as the majority of the most important tree fruits are, "the effects of unsuitable root stocks are far reaching, and the use of such has often led to disaster."

Fourthly, there is the pitfall of self-sterility. Many varieties of fruits, in particular of apples, pears, plums, and cherries, have been shown comparatively recently to be self-sterile, and unless they are interplanted with other varieties, by which they may be pollinated, a barren orchard will result.

The above may be grouped as mistakes of *material*. No less important are mistakes of *nutrition*, such as attempts to grow fruit under unsuitable conditions of climate or of soil, and faulty manurial and cultural treatments.

Obviously the only hope of reducing such mistakes in the future lies in research, which will obtain for the grower more information along both these lines—information about his material and its suitability, and information about the conditions affecting its nutrition.

The two lines must be followed together, because they are mutually complementary. No decision as to what constitutes the right type of tree in a particular case can be made without a general knowledge of the way in which various types react under various sets of conditions.

The Committee considers that particular attention should be given to :—

(*a*) The study of stock and scion and their interrelations.

(*b*) Surveys of fruit areas to determine the relation of various factors to tree growth and fruitfulness.

(*c*) Chemical studies relating to the tree and its crop.

(*d*) The associated Physiological studies.

Passing on to the consideration of other aspects of the fruit industry, the Committee recognises that there is a strong case to be urged for the further development of research on the problems of transport and storage, preservation and by-products and disease control.

The questions of preservation and transport were considered more particularly by a separate Committee, and will be discussed later in the present article.

On the subject of disease control, it is noted that notwithstanding the considerable efforts which are being made by plant pathologists and entomologists all over the world, heavy losses are still sustained by the fruit grower. The lines of investigation specially mentioned as meriting extension in this connection are that concerned with varietal disease resistance and the factors influencing the degree of infection or intensity of attack, and that concerned with new insecticides and fungicides outside the limited group of materials at present available.

Considering these findings in their bearing upon the production of fruit, and other tree crops, in the Tropics, we believe them to be thoroughly sound.

The differences between the requirements of the planter in the Tropics and those of his confrere in temperate regions are differences in degree, and not of kind. They arise chiefly out of diversities of history and are nearly all correlated with the absence from many parts of the Tropics of those extensive local agricultural traditions which are the legacy of centuries of intensive cultivation in more northerly regions. Temperate fruit culture is one of the most highly developed

branches of plant industry, and if the need for research into its problems is urgent, how much greater is the scope for improvement in the cruder technique of the Tropics.

The Fruit Committee of the Imperial Agricultural Research Conference was, of course, not considering temperate fruit exclusively, but on the other hand their Report contains no specific reference to tropical fruit, wherefore some little elaboration of their points may find place here.

Accepting the prime importance of the two aspects mentioned, material and nutrition, the present writer would be inclined to place in the forefront of a research programme dealing with any tree crop in the Tropics a *Survey of Varieties*. In temperate regions commercial interests are involved in the propagation of existing fruit varieties and the breeding of new ones. This has been so for many years, and as a result of nurserymen's activities it is possible, even if not particularly easy, to collect and survey a fair proportion of the existing varieties of any given fruit. In the Tropics, on the other hand, where large numbers of local varieties are scattered all round the globe, and communications are relatively difficult, it is still almost impossible to gauge the potentialities of a crop by observation of the varieties represented in any one country, notwithstanding the considerable amount of plant introduction which has gone on through Botanic Stations and Departments of Agriculture in recent years. The first step, therefore, in investigations on material is to see what is available.

The lines of work suggested by the Committee, which aim at making the best use of the available material, follow naturally after the survey, but a further requirement in the Tropics, not mentioned either by the Fruit Committee or that on Plant Breeding, is improvement of material. Even temperate fruits, of course, are susceptible of improvement, but they have been bred for centuries already, whereas there are tropical fruits which may be destined to play an important part in the world's food supply, but are at present at the stage of the crabapple, potential parents of good varieties, but nothing more.

There are other tropical tree crops, such as cacao, which are grown in a mixed condition, and with these improvement of material, in the form of isolation of good types from the welter of good, bad, and indifferent, is perhaps a more urgent necessity even than research into nutrition, though both should go hand in hand, because in the case of cacao at least, budding seems likely to play an essential part in the process of isolation, and nothing is known of the interactions of stock and scion, and very little about the factors governing fruitfulness.

Equally important with problems of growing fruit are the problems of handling it when grown. A Committee considered the subject of "Research into Preservation and Transport" not only of fruit, but of agricultural produce in general. They pointed out that many problems of this character can only be attacked where the clinical material is available on the spot—a consideration, it may be remarked, which had already led to the decision of the Empire Marketing Board to establish at the Imperial College of Tropical Agriculture an experimental cold-storage plant for investigation of the possibilities of improved methods of transport for bananas.

The three reports mentioned at the head of this article have one point in common, the prominent place given to suggestions of methods for co-ordinating research and facilitating the exchange of information between research workers scattered over the Empire.

Consideration of this point was one of the chief objects of the whole Conference, and it is interesting to note that all three Committees agree about the necessity for some kind of organisation.

The Fruit Committee suggested that an Imperial Horticultural Committee should be set up, on which members well acquainted with horticultural practice and scientific research in horticulture should represent the Horticultural Research Stations in Great Britain, the Ministry of Agriculture, and such self-governing Dominions as are interested in Horticulture, with representatives also of Empire Countries other than Dominions, which might for convenience be grouped.

The Plant Breeding Committee considered that there should be an organisation, but that it could most effectively carry out its functions in close association with existing research institutes engaged on plant-breeding problems.

The Preservation and Transport Committee also suggested the use of an existing institution.

The three schemes agree on the importance of :—

1. Collection, classification, and dissemination of technical information.
2. Establishment of direct contact between institutions or individuals dealing with similar problems. All emphasize the fact that visits by the workers themselves to places where work similar to their own is being done are of the greatest importance.

E. E. C.

* * *

Report of the Committee on Dairying.

THE Committee on Dairying submitted to the Conference a report which dealt with seven aspects of the Dairy industry throughout the Empire. Advance copies of a survey of Dairying and Dairy Research in the Empire by Professor Leitch were circulated to the members of the Committee, and this survey, in the Committee's own words, "afforded striking evidence of the need for further research and of the advantages to be obtained from mutual co-operation and interchange of information." Paragraphs 2, 5 and 6 of this report deal with these points, and emphasise, not unduly, their importance. The last paragraph recommends the establishment of an Empire Dairy Research Committee in London. Thus far we may suppose the Dairy Committee to have trodden the path taken by all the other

Committees who have reported to the Conference: a body of specialists assembled in Committee could hardly do less, and we doubt whether in many cases, such resolutions are really more than pious hopes. It is true this Committee goes a step further than most, and recommends the establishment of an Empire Journal devoted to the publication of papers relating to Dairy Research. The proposal, in view of the multiplicity of Journals of the present day, hardly seems desirable. The Committee are on surer ground when they recommend the standardisation of the glassware used for testing milk and milk products, to the mutual benefit of the worker and the manufacturer; the latter, we presume, would be all-British, though this point is not mentioned. The recommendation is also made that attention should be paid to the study of such defects as are found in the condition and quality of imported dairy produce. There is certainly a very large field for investigation into these points, all along the line, from the time of the production of the milk to the display of the butter in retail quantities in the old country, and the study of a problem like this would have a wonderful effect in linking up the workers at home and abroad.

Dairying is not at present a matter of very great importance in the Tropics, but we are most of us consumers of butter and cheese, and are therefore interested as importers.

* * *

Report of the Animal Nutrition Committee.

THE report of this Committee is commendably brief and to the point. As a result of three meetings, it submits for the consideration of the Conference a very definite proposal that a bureau or centre for the exchange of information on Animal Nutrition, should be established. It proceeds to indicate, in some detail, what it considers the functions of this bureau should be, where it should be located, and how much it may be expected to cost.

It will comfort some of the more nervous Colonies to hear that most of the duties suggested are only to be exercised "on request" and the Committee were doubtless wise to emphasize this, for there is still in some of the less progressive Colonies, a suspicion of all such bureaux, as being, from their nature, likely to interfere. Apparently the only duties which the bureau will perform automatically, are the collection of information and its circulation by reviews, monographs or otherwise, and the examination of Empire products connected with the feeding of animals in cases where local facilities are not available.

It is probable that an Animal Nutrition bureau has more to recommend it than some of the central organisations which other Committees have, no doubt, recommended. Much of our present knowledge of the subject is of very recent date, and we doubt whether, for instance, even the resources of the College Library could produce very much up-to-date information. The solitary worker is obviously very much handicapped, and it will be a great advantage to him to be able to get information when he wants it, while the perusal of an abstract of the work that is being done in this branch of knowledge, will keep him abreast of the subject, and suggest lines of investigation which he might take up.

The Committee in a most businesslike way suggests that this bureau should begin on a small scale, and only when its need has been justified, should the question of expansion be considered, and then at first by temporary workers only. Its financial demands are equally moderate, and it may be hoped that the inception of such a bureau, at the Rowett Institute, as suggested, may not be unduly delayed. It is true that the greater portion of its work will deal with the feeding of animals destined for the butcher, but the general principles of animal nutrition apply to the working animal, and we are sadly in need of more precise information as to the feeding of working animals in hot climates.

* * *

Report of the Committee on Agricultural Economics.

AGRICULTURAL economics is a subject which has only recently secured recognition as being worthy of study. The Agricultural Economics Research Institute, Oxford, was established on a tentative scale in 1913, survived the war and immediate post-war periods with difficulty, and has recently had its staff considerably augmented and its work extended in several new directions. Advisory agricultural economists have also been appointed by the Ministry of Agriculture to various Universities, Colleges, and Experiment Stations in the United Kingdom. Agricultural economics has also been included in most Agricultural College courses and a number of post-graduate research scholarships have also been established. The Ministry of Agriculture has formed a Marketing and Co-operation Branch. Organised development of various degrees has also taken place in the Dominions. While no specialised institution has been set up in India a considerable amount of sporadic effort has been devoted to various aspects of the subject, and the evidence recently given before the Royal Commission on Indian Agriculture has focussed some attention on these problems. In the Crown Colonies agricultural economics has been neglected but it is worthy of note that the students selected by the Colonial Office for service as agricultural officers in the Crown Colonies attend a year's course at the Agricultural Economics Research Institute at Oxford, while some instruction in tropical agricultural economics is given to these and all other students who pass through the Imperial College of Tropical Agriculture.

While these facts are a welcome evidence of awakening interest it is, unfortunately, clear that the British Empire has lagged behind other countries, notably the United States of America in its recognition of the importance of the subject, and that an immense amount of spade work

remains to be done, particularly in the British tropics, before the subject is able to render to agricultural development those services for which it is adapted. In this connection the report of the Committee on Agricultural Economics to the Imperial Agricultural Research Conference is of interest.

Introduction:

(1) The Committee had the advantage of having before it the report of a Committee on Agricultural Economics appointed by the Empire Marketing Board and its recommendations were, to a large extent, guided by the conclusions of that report.

Importance of Agricultural Economics.

(2) The Committee was compelled "to recognise that too little attention has hitherto been given in many portions of the Empire to research in agricultural economics. The Committee attach great importance to the systematic and continuous study of economic conditions as a means of promoting prosperity in Empire agriculture, and would impress upon the Governments of the Empire the need for securing the services of whole-time agricultural economists on the staffs of their Departments of Agriculture."

This is a recommendation of very great importance which it is hoped will be stressed in the proper quarters. Matters rightly coming within the scope of agricultural economics have hitherto been entrusted to officers devoid of the technical knowledge and training essential to a proper understanding of the problem. The result has unfortunately been to prejudice the minds of agriculturists against schemes which properly organised and controlled could become of great value. Further, the amateur economist does not possess that orientation of mind, which enables him readily to appreciate those factors, which, if permitted to develop, must inevitably lead to disaster. Economic enquiry too often partakes of the nature of a post-mortem examination and too seldom that of a preliminary investigation. It is incidentally unfortunate that what the writer believes to be the first demand for an agricultural economist emanating from a Department of Agriculture (Tanganyika) should embrace a variety of subjects, not a single one of which falls within the scope of agricultural economics. The Reports of the Committees of the *Empire Marketing Board* and the *Imperial Agricultural Research Conference* should do something, though not nearly enough, to define and outline the scope of agricultural economics. These subjects the present writer proposes subsequently to develop elsewhere.

Training of Workers.

(3) Assuming that agricultural economics is recognised as a specialist subject, and that Agricultural Departments, particularly in the Crown Colonies, recognise the need of having such officers upon their staffs, there remains the problem of providing the necessary training facilities. So far as the present writer is aware no teaching institution definitely caters for this type, presumably because there are no definite prospects of subsequent employment. The agricultural economist requires specialist training in economics in a general setting of agriculture. The Agricultural Economics Research Institute at Oxford is not a teaching institution except in so far as it provides a brief course in agricultural economics for students under the Colonial Office Scholarship Scheme and it is not suggested that these students can be considered as trained agricultural economists. The Committee has rightly suggested that the attention of Universities throughout the Empire should be directed to the need for providing such training facilities.

Interchange of Information.

(4) The Committee stresses the need for the fullest possible interchange of information both in initiating and developing research in agricultural economics throughout the Empire. While the present stage of development of this subject did not enable the Committee to suggest any single information centre it was recommended that the Agricultural Economics Research Institute, Oxford, and the Horace Plunkett Foundation, should continue to serve as clearing houses of information for the subjects with which they have become identified.

Advisory Committee.

(5) The Committee welcomed the action of the Empire Marketing Board in setting up an Advisory Committee on Agricultural Economics for the purpose of fostering development and mutual assistance between different parts of the Empire, and suggested that the Committee might serve in an advisory capacity to any Institution recognised as an information centre.

Production.

(6)—(*a*) COST ACCOUNTING.—Interchange of informaton between different parts of the Empire regarding the technique of cost accounting is urged. It is desirable that the technique of these studies should be uniform in order that results may be comparable.

(*b*) FARM SURVEYS.—Farm surveys are recommended on account of their value and universal applicability particularly in those parts of the Empire where costings investigations are virtually impossible on any large scale. Here again interchange of information and mutual assistance are highly desirable.

Economic Surveys.

(7) The Committee recommended the extension of the survey method on a wider comparative basis to serve national and inter-Imperial purposes, and not merely local and individual needs. Such information would supplement public statistics and should throw light on variations in costs of production and results obtained from different systems of farming. Such surveys "combined with marketing studies should provide valuable guidance in framing Governmental Agricultural policies, with particular reference to the development and settlement of new areas."

It is greatly to be regretted that Governmental Agricultural policies in the past have been determined with but scant reference to fundamental economic factors. The agricultural economist properly equipped, could, eventually, supply this essential basic data.

Marketing.

(8) Among the chief objectives of marketing research are the abolition of waste and the lessening of price fluctuation. Continuous research both into the internal and external marketing of the agricultural produce of each country is essential. Owing to the special importance of the United Kingdom market for the surplus agricultural produce of the Empire, marketing research in the United Kingdom offers special facilities and scope for inter-Imperial effort, a fact which has received recognition from the Governments of the Empire in appointing the Imperial Economic Committee to study the marketing of particular commodities selected by agreement among the Governments. The British Government has provided machinery in the Empire Marketing Board for implementing the recommendations of the Imperial Economic Committee. The Committee regarded this research, coupled with market intelligence, as one of the most effective means of benefiting Empire agriculture. The mechanism of marketing has been the subject of more irresponsible controversy than perhaps any other branch of agricultural economics, and one which has received the least systematic investigation. The considerable interest now devoted to the subject is belated.

The World Agricultural Census of 1930.

(9) Attention of the Governments of the Empire is drawn to the need for co-operation in the proposed World Agricultural Census of 1930 which affords an opportunity for acquiring vital information concerning the agricultural industries of the Empire. It is to be hoped that this matter will receive the early attention of the Governments concerned.

The Report received a most cordial reception from the Conference—perhaps too cordial in the sense that more is expected of the subject than it can, in its present stage of development, contribute. Years of continuous and systematic research work are required before agricultural economics can take its place side by side with other branches of science in its relation to agriculture. The immediate desiderata are the systematic training of agricultural economists, and the stimulation of research work preferably at centres of research where the agricultural economist can work at fundamental aspects of the problem undisturbed by popular clamour which almost invariably leads to the premature publication of results. The absence of several notable branches of agricultural economics from the report may be attributed to the prejudice aroused by the irresponsible activities of enthusiastic amateurs. Altogether the report is one which augurs well for the future.

C. Y. S.

CO-OPERATIVE SOCIETIES.

Ceylon Report for 1925-26.

THE Report of the Registrar of Co-operative Credit Societies, Ceylon, for the year ending 30th April, 1926, has recently been received. The general progress of the societies is shown briefly in the following table :—

Year.	No. of Societies.	No. of Members.	Paid-up Capital.	Reserve Fund.
			Rs. c.	Rs. c.
1913-14 ..	37	1,820	8,200 00	23 25
1919-20 ..	136	15,200	99,284 00	14,662 72
1925-26 ..	315	34,164	362,987 08	73,183 39

During the year under review 64 new societies were registered while the registration of 6 societies was cancelled, leaving a net increase of 58 societies. The total number of members showed an increase of 3,616. The paid-up share capital of all the societies increased by Rs. 81,508.22 to Rs. 362,987.08 giving an average per member of Rs. 10.06, and per working society of Rs. 1,255. The total amount lying to the credit of members as deposits in all the societies at the end of the year was Rs. 57,075.43, an increase of Rs. 14,049.01. Reserve funds aggregated Rs. 73,183.39 compared with Rs. 65,161.99 at the beginning of the year. Gross profits increased while expenses decreased, the net profits being Rs. 32,701.20 in 1925-26 and Rs. 27,083.11 in 1924-25. This amount after making provision for reserve fund, was credited by the societies to members as annual bonuses on paid-up shares, many societies utilising the bonuses for increasing their share capital. Loans totalled Rs. 444,035.24 and repayments Rs. 328,289.83 both figures exceeding those for the previous year. The amount of loans outstanding at the end of the year was Rs. 601,715.81 as against Rs. 484,604.94, indicating an increase of business. Loans totalling Rs. 207,170.37 are overdue. The working capital of the societies, consisting of share capital, deposits, loans, and profits, reached Rs. 816,108.14, of which, it is interesting to note, Rs. 541,946.41 is the owned capital of the societies. (1)

Statistically this brief summary would appear to indicate a most satisfactory state of affairs. The most satisfactory feature of the report is, however, the fact that the Registrar is far from satisfied with certain features of the existing position. Nevertheless he writes "I wish to emphasize my conviction of the great possibilities before co-operation in the economic development of our rural areas." The recognition of this difference between what is and what might be, is an assurance that progress will be directed along sound lines. In the experience of the present writer the worst systems are those whose responsible officials are perfectly contented with what is.

(1) It is unfortunate that the Balance Sheets of the Societies, printed as an appendix to the Report, should contain several errors.

The most disturbing feature is the heavy amount of overdue loans, a matter which requires very serious attention. This is attributed to "a lack of knowledge of business methods. Too often loans are taken for purposes which are not economically sound, and yet too often are loans granted by committees without adequate enquiries. Such actions lead to difficulties in repayments, delays, and eventually unpleasant recourse to legal remedies. This is the weakest part of co-operation in Ceylon at the present time, and will only be remedied by education and constant supervision for a fairly long period." With these observations the writer thoroughly concurs. It is absurd to assume, as so many do, that a society must succeed because it is called a Co-operative Society. Even in a society in which there is real co-operation there still remains the same need for strict adherence to business principles and methods as in a private enterprise. The trouble is that in so many of the so-called Co-operative Credit Societies there is no co-operation whatever.

One of the greatest needs of Co-operative Credit Societies everywhere is some mechanism which will ensure that loans are granted only for purposes offering a reasonable prospect of success, that the amount granted is adequate when all forseeable factors and resources are taken into consideration, that the period of the loan is sufficient to enable the borrower to realise sufficient from this or other activities to enable him to meet interest charges and repay the capital loan, and that the money so loaned is definitely devoted to the purpose for which it was borrowed. This can only be ensured by real and active co-operation.

One of the greatest weaknesses of the present structure of co-operation in the tropics lies in the fact that the demand for facilities which the system affords did not arise from the people who require them. The Government has become the proselytising, organizing, controlling, and in too many cases, the financing agent. It is satisfactory to note that, in Ceylon, the members themselves provided a very large proportion of the working capital. There is also a definite effort to provide instruction on matters co-operative. Classes for the training of secretaries, treasurers, and other honorary workers were held at various centres. Preceding these classes representatives confer to discuss papers and reports. Lectures are also given to students of the Farm School at Peradeniya, and the Jaffna Farm School. Registrar's Circulars Nos. 12 and 13 on "Further Instructions on the Reserve Fund" and "On the Calculation of Interest on Deposits," were published and distributed to all societies. Work of this nature is of great value in stimulating and maintaining interest.

While most societies confine their activities to the provision of credit some have commenced to purchase manures, implements, barbed wire, &c., and to sell produce for the benefit of their members. This development is an important and useful one, but requires very careful control.

C. Y. S.

RICE IN BURMA.

Production, Trade and Improvement.

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Deputy Director of Agriculture, Southern Circle, Burma.

I. Production.

JUDGED by natural standards Burma should be rich indeed, for of grain, timber, and oil it has enough and to spare. These three natural products constitute its chief wealth and are produced in great abundance leaving large surpluses for export; and the amounts of grain, of timber, and of oil contributed to the world's trade are far from being unimportant. The oil is mineral oil from the well known oil fields on the banks of the Irrawaddy: the timber, teak, of which valuable wood Burma is the chief source of supply; and the grain, rice, of which it is the world's largest individual exporter. A considerable revenue is derived from the royalties on oil and teak but rice contributes most to the revenues of the country if we add to the export duty of three annas per maund ($82\frac{2}{7}$ lb.), the land revenue from the vast areas devoted to the cultivation of this crop.

The acreage under rice in Burma is now over eleven million acres—the latest figures for 1926-27 being 11,558,371—out of a total cultivated area of sixteen million acres: and in Lower Burma districts it is practically the only crop grown, large stretches of the Delta land being suitable for nothing else. With a comparatively small population of thirteen and a half millions, about half the rice crop only is consumed in the country, and the other half is available for export. In India, while there are three Provinces with a greater rice acreage than Burma, and one in which rice monopolises the cultivated area more completely, such is the density of the population that it is found necessary to import large quantities of Burma rice annually to meet requirements. Rice is the staple food in Burma, but with a comparatively high ratio of ·85 of an acre per head of population under this crop, and with an average production of 1,840 lb. of paddy or rough rice, per acre, a surplus of approximately 5 cwt. of cleaned rice per head of population is left over after home consumption needs have been met.

In considering the production of rice in Burma it is essential to understand the three main climatic zones into which the country is divided. In the South there is the Lower Burma wet zone which receives directly and without interruption the rains brought by the South-west monsoon from May till November. In this tract the rainfall varies from 50 to 130 inches, the annual precipitation in any one part being fairly uniform. In this zone may be included two coastal strips in the South-east and North-west of the Delta, where on account of high hills on which the monsoon impinges, the rainfall is very much greater, being over 200 inches, and in parts as high as 300 inches during the year. To the North

of the wet zone proper there is a dry zone in Central Burma lying behind and to the East of the Arakan hills which intercept the rain bearing clouds. In this dry zone the rainfall is generally under 35 inches, and in places has as low an average as 18 inches. To the North of this area occurs the Upper Burma wet zone which is a tract of hilly and comparatively undeveloped country where the rainfall is in the neighbourhood of 70 inches.

It is in the Lower Burma wet zone with its 9½ million acres of paddy land that the greatest part of the rice crop is grown, and it is here that the exportable surplus is produced. It is almost entirely rain-fed and there are no canal irrigation systems. The rice which is grown in the dry zone is eked out by irrigation, and the produce is mostly consumed locally; but the total area of rice which receives irrigation is only 1,373,472 acres being 9 per cent. of the whole. Even in irrigated areas the crop is grown during the rainy season, and the methods of cultivation are similar for the whole country.

After a dry period, beginning in early November and lasting till May, during which practically no rain falls, the South-west monsoon breaks at the end of May and the rainy season lasts till the end of October. In a typical rice growing district with a rainfall of 96 inches, the distribution over this period and the maximum and minimum shade temperatures are as follows:—

	MAY.	JUNE.	JULY.	AUGUST.	SEPTEMBER.	OCTOBER.	NOVEMBER.
Rainfall	Inches 9.45	Inches 20.31	Inches 17.83	Inches 21.12	Inches 16.63	Inches 5.81	Inches 2.33
Max. Temp. F....	Degrees 90	Degrees 85	Degrees 83	Degrees 86	Degrees 88	Degrees 89	Degrees 89
Min. Temp. F	77	76	75	76	75	73	73

These figures are taken from the reports of the Hmawbi Agricultural Station and represent the averages of 7 years. When the rainy season has ended in November no more rain of agricultural importance is expected till the following May. This means that one crop of rice only can be grown on the land, and as the long hot dry spell bakes the puddled soil into a brick-like hardness, no other crop has yet been found able to establish itself during this part of the year. Were irrigation facilities available during the dry season this could be altered, but in the absence of water no further cultivation is possible. In special localities such as round the edges of small lakes, rice is grown out of season, but these places are of minor importance, and as the time and methods of cultivation are very similar throughout the country, an account of the practices followed in Lower Burma will serve for all.

The crop is grown entirely by small holders, the size of holding varying from 10 to 50 acres, with an average holding in Lower Burma of from 20 to 25 acres. The cultivators have their permanent dwelling houses in villages dotted about on the extensive paddy plains which form the delta of the Irrawaddy and lesser rivers. During the rainy season temporary bamboo mat and thatch huts are erected on each paddy holding for convenience in working the land; but when the crop has been threshed and sold off, the cultivator returns to the amenities of his village for the hot weather. There is no mixed cropping; and although in one or two districts a fair number of homesteads are found with the cultivator and his family living permanently on the land, over the greater part of the delta these are conspicuous by their absence.

When the hard sun-baked fields have been softened by the May rains, and the gleam of water has asserted itself as the chief feature of the landscape, the cultivator wakes into activity and the work for the season commences. The nurseries are first ploughed and harrowed. These constitute about one-tenth of the holding and are among the highest fields, from a few inches to a foot or so above the general level, and rendered thereby safe from sudden floods. All the fields are small, seldom exceeding half an acre in extent, but they are exceedingly irregular both in size and in shape. They are enclosed by small embankments which follow to a certain extent the almost imperceptible contours of the land, and have for their sole object the retention of the water in the fields at a fairly uniform depth. When ploughing and repeated harrowings have reduced the soil of the nursery to a smooth homogeneous mud about 6 inches deep, the excess of water is run off as far as possible and seed is broadcasted at the rate of 500 lb. per acre. Before sowing, the seed is soaked in a water pit for forty-eight hours, and sprouted for two or three days in a heap covered with large leaves and sacking. This sprouted seed sinks at once in the shallow water and gets hold of the ground immediately, producing in a few days that wonderful green colour in which the young paddy nursery has no rival. Here it is allowed to remain for six weeks while the rest of the paddy fields are ploughed and puddled into a proper consistency The implements used are primitive but efficient, and sufficiently light for bullock draught, while the use of two sorts of rotary blade cultivators adopted within fairly recent times levels off and completes the cultivation of the

fields in a very workman-like fashion. A field ready for transplanting exhibits a placid sheet of shallow water with no blade of grass or weed breaking its surface.

The bulk of the paddy is transplanted. The arduous labour of pulling the nursery seedlings out by the roots is done by men ; but the equally back-aching work of planting the seedlings in small bunches about 6 inches apart is done by women and girls.

For this they receive men's rates of wages, and the whole operation of transplanting is fairly expensive. Except on the poorer soils however it pays and increases the crop by 15 to 20 per cent. One acre of nursery plants out 10 acres of transplanted field, the nurseries themselves being replanted after a further cultivation. Transplanting becomes general by the middle of July, and while late places continue planting into September and even October, most of the transplanting is finished by the end of August. Late places are those in which it is essential to wait until the August floods have subsided before attempting to trust a crop in the ground.

After the thorough preliminary cultivation which is usual, there is little or no weed growth, and the cultivator has not much to do until towards the end of November when the crop begins to mature and harvesting operations commence. The end of the rains is usually marked by stormy weather conditions in which the standing crop is liable to be blown down and laid in all directions, increasing the difficulties of reaping. To obviate this it is a common practice when the water in the fields begins to dry up, to flatten out the crop in one direction with a long bamboo pole.

Reaping is done by hand using a small curved sickle with a finely serrated edge. As a handle, a buffalo horn is often used which emits a hollow note when the edge of the sickle is drawn across the straw in cutting. A long stubble is left on the fields, only about a foot of straw being removed with the panicle. Near large towns this stubble is reaped again for fodder, but in no case is the full length of straw reaped with the grain. The cultivator himself does not require more than a foot of straw for feeding his bullocks, and the shorter the straw the easier is the subsequent threshing. When the straw left on the fields is coarse and long it is set fire to in the hot weather of March and April and burned off. This is on the whole a wasteful practice but it also serves some useful purposes, destroying insect larvae, partially sterilising the surface soil, and clearing the ground very effectively for cultivation in the next season.

After reaping, the heads of paddy with their short lengths of straw are made up into sheaves and carted direct to the threshing floor, round the four sides of which they are heaped with butts pointing outwards. The threshing floor is simply a paddy field scraped smooth by means of a simple bullock implement, and plastered over with a mixture of cattle dung and clay. This forms a smooth hard surface on which the threshing is done by bullocks treading out the grain. It is a slow process, however, the outturn of threshed grain per bullock being under 190 lb. in a nine hour work day. Winnowing is also done by so-called natural means, and consists of handing up the grain, basket by basket, to a man on a triped bamboo platform 10 feet high, from which it is allowed to trickle to the ground again. The wind carries away the chaff and dust leaving a comparatively clean grain heap below. These methods of threshing and winnowing are primitive and cost about four times as much as the same operations performed by a power driven threshing machine. Under the existing conditions of small holdings, however, and with no means of road communication whatever between holdings, the introduction of threshing machines is not a practicable proposition. Threshing and winnowing are carried out during January and February, and the paddy is mostly disposed of by the cultivator towards the end of the latter month. As his production processes, however, finish on the threshing floor with the cleaned grain which then becomes an article of commerce, this will be dealt with in the next chapter.

The time the main crop is in the ground is about five and a half months but there are varieties which can mature in three to four months and others which require seven. The cost of producing an acre of paddy at ordinary hired rates of labour, excluding rent, is Rs. 25/- ; but for the cultivator who gets a certain amount of free family labour this figure could be reduced considerably. The normal yield per acre of paddy or rough rice for the whole province is 1,480 lb. On the threshing floor the value of this is in the neighbourhood of Rs. 50/- or approximately £3 10s.

The main crop is not manured, the small quantity of cattle manure available being used entirely on the nurseries. There is no breeding stock of cattle in the delta, and the brought-in animals average one pair of working bullocks for every ten acres of paddy land. This pair produces about six tons of dung in the course of the year, and even this is not carefully conserved ; so that the dung which ultimately reaches the paddy fields is about three or four tons per acre of nurseries which constitute only one-tenth of the whole. Artificial manures are not used at all, but the crop yield can readily be increased by 50 per cent. by using ordinary nitrogenous and phosphatic manures, excluding nitrate of soda which has a marked detrimental effect under aquatic conditions. The cost of artificial manures which have to be imported is high, and the money value of an acre of paddy being low, the use of such manures has hitherto been impracticable ; but with the steady increase in the price of paddy which is occurring, and cheaper chemical manures becoming available, conditions are changing, and the prospect of artificial manuring becoming a paying proposition is improving. There are no indigenous manures available in quantity, and owing to the extreme rapidity with which the paddy soils dry out after harvest, green manuring is not feasible. The ordinary paddy land does

not receive an annual deposition of silt from the rivers, and paddy land which is so silted is usually in a precarious position, where owing to floods the cultivation of paddy is a speculative business. In spite of annual cropping and the absence of any system of manuring the fertility of old land is not markedly declining, and the level of production maintained under these circumstances may be considered high. The soils are mostly old alluvium, and vary from fairly light sandy loams to the stiffest of clays. The medium loams are the best and their powers of recuperation are great: but there appears little doubt that the hot weather desiccation which takes place during the long dry spell of six months is a considerable factor in the maintenance of fertility.

The freedom of paddy grown on such an extensive scale from pests and diseases causing widespread damage is notable, but considerable local damage is done from time to time by (1) borers, (2) leaf rollers, (3) army worms, (4) the rice hispa and crabs; and by the fungal diseases, (5) bunt, (6) false smut and *sclerotium oryzae*.

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(1) *Shoenobius bipunctifer.*
(2) *Nymphula fluctuo alis.*
(3) *Cirphis Unipuncta.*
(4) *Hispa aenescens.*
(5) *Tilletia horrida.*
(6) *Ustilaginoidea virens.*

(*To be continued.*)

IN concluding his address at the eighth annual general meeting of the Ste. Madeleine Sugar Company, Ltd., Mr. George Moody Stuart, Chairman of the Company stated, "I would like to refer in a word to the Imperial College of Tropical Agriculture, 35 miles distant from Ste. Madeleine. I am glad to day that Ste. Madeleine has been able to be of some service in various ways to the College, and I am also glad that Mr. Skinner, our manager, says that any help given to the college has been repaid many times over by the benefits Ste. Madeleine has received from it. The professors are frequently on our estates carrying on their investigations for their own purposes, but you can well understand that we often profit from the results of these investigations. I feel sure the other estates throughout the island have had a similar experience, and, indeed that the whole community, which gives generous support to the college, receives an ample return from the advantages that accrue from having the college established in their midst."

The subscription to *Tropical Agriculture* is six shillings per annum, post free, to all countries within the British Empire or seven shillings, post free, to all other countries. Subscriptions can commence at any time during the year.

THE IMPERIAL INSTITUTE.

Annual Report.

A NEW chapter in the life of the Imperial Institute was opened by the passage of the Imperial Institute Act, in May, 1925, and the first annual report of the new Director, Lieutenant-General Sir William Furse, K.C.B., D.S.O., has recently been published. The Advisory Council on Plant and Animal Products, under the chairmanship of Sir David Prain, was set up in March, 1926, to advise on all matters relating to the utilisation of these groups of Empire raw materials. Advisory technical committees have dealt with special problems; the Silk Committee has prepared a memorandum on silk production of the Empire, the Timber Committee has completed the preparation of a descriptive list of Empire timbers. At the request of the Indian Agricultural Commission, the Committee on Vegetable Fibres has furnished a memorandum giving information as to the quality of Indian hemp together with recommendations for its improvement. Other Advisory work has been done by the Committees on Animal Fibres, Oils and Oilseeds, Essential Oils and Resins. The Intelligence Section of the Department deals with enquiries for technical and commercial information respecting the production, utilisation and marketing of Empire raw materials of plant and animal origin. The section is also responsible for the collection and indexing of published and other information. During the year 1927 the Section has dealt with 929 enquiries relating among others to citrus products, tapioca flour, papain, chicle gum, oil palm cultivation, eucalyptus, cultivation, manila hemp, tobacco in Rhodesia, ginger and ginger peelings from Sierra Leone, and cascara bark from Kenya Colony.

In accordance with the present tendency for co-ordination in scientific work, close touch is being maintained with Government Departments and other institutions engaged in research and the following have been referred to throughout the year:—the Department of Scientific and Industrial Research; the Forests Products Research Laboratory; the Imperial Forestry Institute at Oxford; the Empire Forestry Association; the Royal Botanic Gardens, Kew; the Imperial Bureaux of Entomology and Mycology; the Natural History Museum; the Wellcome Chemical Research Laboratories, and other institutions. Work of a similar nature has been undertaken by the Mineral Resources Department.

During the year under review much time has been devoted to the rearrangement of the Exhibition Galleries and these have been rendered more attractive by the preparation of several model panoramas. The library which specialises in publications relating to Tropical Agriculture, contains some 40,000 publications, and during the year 3,650 new publications and 25,136 periodical publications were received.

G. W.

CHEMICAL NOTES.

Compiled by the College Department of Chemistry and Soil Science.

Moth Repellants.

Investigations at the Mellon Institute at Pittsburgh, U.S.A., conducted by Dr. Lloyd E. Jackson and Miss Wassell (*Indus. Engin. Chem.* Oct., 1927, p. 1175) have shown that cinchona alkaloids and their derivatives are very effective moth repellants, and that they may be successfully employed in dyeing, dry-cleaning and storing clothes and furs. They are inodorous substances; they adhere to the materials to which they are applied; they can be added evenly, and they do not adversely affect the treated articles. Cinchona alkaloids are soluble in cheap commercial solvents, such as naphtha, as well as in water. They are not poisonous to human beings.

More than forty patents have been taken out in the United States during the past fifty years for moth-repelling preparations, but most of the substances so far suggested are not very efficient in their action. On the other hand, cinchona alkaloid preparations have complied with all requirements. On the whole, quinidine salts are the most economical and cheapest among the alkaloids tested. They may be applied by spraying their solutions in water or in petroleum naphtha over the materials or articles which it is desired to protect.

* * *

The Products of Wood-Sugar Fermentation.

When wood is digested for about fifteen minutes with dilute (2 per cent.) sulphuric acid in an autoclave at 120 pounds pressure, "wood-sugar" is produced. This comprises a mixture of hexose sugars and pentose sugars. The hexose sugars are fermentable by yeast, yielding ordinary alcohol and carbon dioxide. They therefore furnish a cheap source of commercial alcohol. The pentose sugars, however, are not fermentable by yeast. So far, they have been discarded, and thrown away with the still residues. It would be useful it they could be made instead to yield a commercially valuable substance. Hard woods yield about 65 per cent. of their total sugar products in the form of pentose sugars, and soft woods, about 35 per cent.

Recent work at the U.S. Forest Products Laboratory, (*see Indus. Engin. Chem.* Oct. 1927, p. 1162) has proved that pentose sugars may successfully be treated with cultures of certain bacteria, so as to form acetic and lactic acids. Both these acids find extensive uses in industry. The most active bacteria were isolated from sauerkraut and silage. Spent liquors from the vats where wood-sugar had previously been fermented by yeast, were inoculated with these organisms. To promote bacterial growth, the liquors were neutralized with excess of lime, and a little yeast as source of nitrogen was added to them. In ten days time, bacterial action was complete. Trials showed that, in this manner, 76 per cent. of the pentose sugars left in the vats where Douglas Fir wood-sugar had been fermented, was converted into acetic and lactic acids. Nearly the same result was obtained with hard-wood pentose residues. Whilst yeast proved to be the best sort of nitrogenous food for the acid-forming bacteria, ground blood-meal and malt-sprouts were found to be nearly as good, and would be preferable in commercial processes. The ratios of acetic acid and lactic acid produced by the process were 1 to 7 for soft wood and 1 to 3 for hard wood.

It is concluded that the manufacture of acetic and lactic acids from spent wood liquors is feasible. The next stage is to work out a large-scale commercial process. The methods suggested could doubtless be applied to many woody plant products other than wood; for example, corncobs, peanut shells, and perhaps sugar-cane megass.

* * *

Synthetic Rubber.

It is reported in the German Press that the I. G. Farbenindustrie has developed a process for the manufacture of synthetic rubber, which has so far passed the experimental stage that large-scale production may be anticipated. Herr von Weinberg, a director, is stated to have said that the cost of production had been brought so low that synthetic rubber could compete with the natural product. Information from another source, however, seems to imply that the experimental stage has not yet been completed, and that commercial production is hardly probable at present.—(*Journ. Soc. Chem. Indus.*, 18th Nov., 1927, p. 1088.)

* * *

Commercial Chlorophyll.

The green pigment of plants contains magnesium, which can be displaced from combination by the use of acids. The acid product is called pheophytin, which possesses a brown colour. By treating pheophytin with zinc or copper salts, beautiful green zinc or copper compounds are obtained. These find application in various industries as colouring matters. The copper compound is the most stable of the metallic derivatives of chlorophyll. It retains its brilliant green colour even after long exposure to light. It finds chief use in commerce. Nettle leaves are employed in its manufacture. The substance costs about one dollar a pound. It is used for colouring bleached cotton-seed oil, olive oil and other seed oils, stearin candles, leather, waxes, resins, pomades, ointments and vaseline, soaps and mineral oils.

Pure chlorophyll (not the copper derivative) is employed in therapeutics. It appears to exercise a stimulating effect on cells of body organs, especially the heart and intestines. It is sold in tablet form, and various claims are made regarding its virtues.—(*Indus. Engin. Chem.*, Oct., 1927).

REVIEWS.

MARKETING OF FARM PRODUCTS by Alva H. Benton, PH.D., A. W. Shaw Company. Pages xv+ 427. Price $3.00.

An analysis is made of the scope of marketing, its mechanical make-up, the methods used, and the services rendered. The marketing of the most important agricultural products of the United States is taken up in separate chapters. Both the private and the co-operative agencies and the services rendered by them are given careful consideration. The marketing of some of the less important agricultural products has also been included, because of some distinctive features connected with them. The concluding chapters review marketing legislation relating to the marketing of agricultural products and point out essential factors and difficulties involved in the co-operative marketing of such products.

The treatment throughout is full and satisfactory, many of the problems discussed being likely to arise in the marketing of similar products in other parts of the world.

G. W.

* * *

GREEN MANURING: PRINCIPLES AND PRACTICE. A. J. Pieters, PH.D., Wiley Agricultural Series. John Wiley & Sons, Inc., Chapman & Hall Ltd., London, pp. xiv + 356. Price 22*s*. 6*d*.

The author may be congratulated on his determination in producing this volume of three hundred and fifty odd pages on the subject of Green Manuring, for he has stretched his subject to its uttermost limits. Starting with a discussion on the Malthusian doctrine, and the race between population increase and food supplies, the writer proceeds to an historical sketch of Green Manuring which leads him, in Chapter III (p. 16), to a general consideration of the amount of organic matter in the soil, its source and the influences which operate for its destruction or increase, as a preliminary to the study of green manuring. This portion of the book (Chapter III Seqq.) with the convenient summaries at the end of each chapter, occupies eight chapters, and is a useful and up-to-date presentation of the subject. Chapter XI describes in considerable detail the crops used for Green Manuring, after which Chapters XII and XIII deals with Green Manuring in the United States, and other countries. A final chapter is entitled "Economics of Green Manuring."

It will be seen that the ground is very completely covered, but it may be doubted whether the book will meet any great demand. The descriptions of agricultural practices in different countries are not given in sufficient detail to be of much value, though an extensive bibliography shows where further information can be obtained. The portion dealing with the Tropics will naturally be of most interest to our readers, but the list is short and of little interest, and many minor inaccuracies were noticed. The distinction between India and the East Indies is not clear, though later the expression Dutch East Indies provides a clue. The Pigeon Pea is not *Cajan indicum*: Astralagus (p. 231) is incorrect, it is properly spelt elsewhere Astragalus. And surely (p. 162) an experiment conducted in 1900 on plots which were not even duplicated, is not up to modern standards of accuracy. Misprints too are numerous and irritating. The illustrations, mostly from the U.S.A. Department of Agriculture, are excellent; the book is printed on very heavy paper and is by no means cheap.

R. C. W.

* * *

IRRIGATION AND DRAINAGE, by F. H. King, Rural Science Series. Macmillan & Co. Ltd., pp. xxxi + 302. Price 12*s*. 6*d*.

This is the eighth edition, dated 1922, of a work first published in 1899, to which no revision since appears to have been done. The book still remains the standard work on the subject, and is commended to the notice of any one interested in the practical details of the application of water to the production of crops, and the difficulties likely to be met. The book does not pretend to deal specially with irrigation in the Tropics, and thus does not emphasize the value of irrigation water in enabling valuable crops, e.g: turmeric or betel vine, to be grown which could not otherwise be considered, as opposed to the practice more prevalent in temperate climates, of making certain of a higher yield of the ordinary rain-fed crops; an instance of the latter may be seen in the famous water meadows of Craigentinny. The illustrations are excellent and deserve a special note.

R. C. W.

* * *

A CO-OPERATIVE HAND-BOOK.—Prepared by order of the Honourable Minister for Agriculture, Punjab, pp. ii + 118. Lahore, 1927.

This useful publication gives an account of the organisation and work of co-operative societies in the Punjab. It is interesting to note that the broader question of the application of economics to agriculture is being tackled by the Co-operative Department. The works of Messrs. Darling & Strickland are known already, whilst a new publication, Mr. Calvert's "Wealth and Welfare of the Punjab" bears testimony to the value of investigations undertaken.

G. W.

* * *

PUNJAB MANUAL OF CO-OPERATION.—This is a collection in a binder of the Co-operative Societies Act, ii of 1912, various forms for administrative purposes, and the by-laws of the different co-operative societies of the Punjab. Considering the importance of the work there done, these documents should prove useful guides to those faced with the task of organising societies, or useful references to those at present in charge of such societies.

G. W.

GUIDE TO CURRENT OFFICIAL STATISTICS OF THE UNITED KINGDOM, Vol. V, 1926. H.M. Stationery Office. Price 1s.

This volume prepared by the Permanent Consultative Committee on Official Statistics, constitutes the fifth detailed annual survey on statistics contained in Government Publications issued by the Departments in Great Britain and Northern Ireland, and relates primarily to the year 1926. The method of use of the subject index, which is given in the explanatory introduction enables one to discover the sources of any official statistics likely to be needed.

G. W.

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ROYAL COLONIAL INSTITUTE BIBLIOGRAPHIES Nos. 2-4. Royal Colonial Institute, Evans Lewin, M.B.E. Price 1s. 6*d*.

These bibliographies are extremely useful in indicating valuable sources of information with regard to the relationship between Great Britain and the Overseas Empire. No. 2 deals with the Constitutional Relations between the various parts of the British Empire. No. 3 with recent publications illustrating the relationship between Europeans and coloured races and No. 4 with works relating to communications of the Overseas British Empire with special reference to Africa generally and the Baghdad railway. These compilations by Mr. Evans Lewin, M.B.E., Librarian, Royal Colonial Institute, are made on a systematic plan and include not only books but articles from journals.

G. W.

* * *

THE SOIL, by F. H. King, Rural Science Series. Macmillan & Co. Ltd., pp. 303. Price 10s. 6*d*.

Even the best text books need bringing up-to-date, and it will not be questioned that our ideas on the soil have changed considerably since 1893, the date when this book was first issued. The present reprint is dated 1922, and is identical with a copy dated 1919; indeed there is no evidence that any change has been made in the work since it was first published. In the circumstances, the work can hardly be recommended to anyone who wants to put himself in touch with modern ideas about the soil.

R. C. W.

* * *

FARM ACCOUNTING PRINCIPLES AND PROBLEMS.—By Karl F. McMurry, M.A., C.P.A., pp. xiii+ 329, Chicago & New York, A. W. Shaw Company.

Chapter three on special features and problems of farm accounting is worthy of attention, and part two on farm cost accounting scores over many expositions of a like nature by its adequate and reasonable examples. Throughout the work is very useful.

G. W.

BOOKS RECEIVED.

WE have to acknowledge the receipt of the following books:—

AGRICULTURE.

Green Manuring. A. J. Pieters, pp. 356, illustrations 80. *Chapman & Hall*, 22*s*. 6*d*.

Fifty Famous Farmers. L. S. Ivins and A. E. Winship, pp. 408, illustrations 85. *Macmillan*, 8*s*. 6*d*.

The Soil. F. H. King, pp. 304. *Macmillan* 10*s*. 6*d*.

Irrigation and Drainage. F. H. King, pp. 502. *Macmillan*, 12*s*. 6*d*.

BOTANY.

Mycorrhiza. M. C. Rayner, pp. 246, plates 7. *Wheldon & Wesley, Ltd.*, 21*s*.

ECONOMICS.

The Economics of a Norfolk Fruit Farm, 1923–26. C. W. B. Wright and R. McG. Carslaw, pp. 62. *University of Cambridge, Farm Economics Branch*, 2*s*.

Markets and Fairs in England and Wales, Part 2. pp. 162, illustrations 41. *H.M.S.O.*, 2*s*.

ENTOMOLOGY.

A Catalogue of Trinidad Lepidoptera Heterocera. W. J. Kaye and Sir Norman Lamont, pp. 144, plates 2. *Government Printing Office, Port-of-Spain*, 5*s*.

GENERAL.

Official Year Book of the Union of South Africa, No. 8. J. E. Holloway, pp. 1130. *Government Printing Office, Pretoria*, 5*s*.

Brief Sketch of British Honduras. Major J. A. Burden, pp. 44. *West India Committee*.

MEDICAL.

Report of the Medical Research Council for the year 1924–25, pp. 164. *H.M.S.O.*, 3*s*. 6*d*.

Report of the Medical Research Council for the year 1925–26, pp. 162. *H.M.S.O.*, 3*s*. 6*d*.

TECHNOLOGY.

Sugar. G. Martineau, pp. 360. *Sir Isaac Pitman & Sons, Ltd.*, 3*s*.

THE Secretary of State for the Colonies has decided to appoint provisionally an Economic and Financial Adviser on questions involving the economic development and financial problems of territories, the administration of which is subject to his control. He has selected Sir George Schuster, K.C.M.G., C.B.E., M.C., now Financial Secretary to the Government of the Sudan.—(*The West India Committee Circular*, Vol. XLII, p. 399.)

COLLEGE NEWS.

Mr. C. Y. Shephard, Professor of Economics, returned to Trinidad from England on 18th November, by the s.s. *Coronado*.

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Professor T. B. Wood, Draper Professor of Agriculture in the University of Cambridge, and Joint Editor of the Journal of Agricultural Science, has been nominated to represent Cambridge University on the Governing Body until the end of the term for which Sir Arthur Shipley had been appointed.

* * *

The following appointments have been obtained by Students who were at the College for the Session 1926-27 :—

Mr. T. D. Rutter, Agricultural Officer, Zanzibar.

Mr. L. G. Bentall, Assistant Agricultural Officer, Kenya.

Mr. W. P. K. Findlay, Assistant Mycologist under the Forest Products Research Board, England.

* * *

His Excellency the Governor of Trinidad, in response to a request of the Governor of Barbados has conveyed to Dr. Seagar, Professor of Tropical Sanitation and Hygiene, the thanks of the Government and people of that Colony for the valuable services he rendered in initiating and organising steps for the suppression of the present outbreak in that Island of an epidemic of malarial fever. The Board of Health, Barbados, has also expressed its grateful appreciation of Dr. Seagar's assistance, which has been brought to the notice of the Secretary of State for the Colonies and the Legislature of Barbados.

* * *

The Trinidad Science Club opened its 1927-28 session on 20th October, with a lecture by Mr. Harold Lyon of the Experiment Station, Hawaiian Sugar Planters' Association, Honolulu, on "Sugar-cane Experiments in Honolulu." On 24th November, Mr. G. Evans, Principal of the College, gave an address on "Cotton as a factor in the closer settlement of Queensland." On the 15th December, Mr. H. C. Taylor, Entomologist in the service of the Fiji Government spoke on "Biological control of pests with special reference to the Coconut Industry of Fiji." The last two lectures were illustrated by effective lantern slides.

The officers for the present session are :

President .... Mr. G. Evans.

Vice-Presidents { Dr. S. C. Harland. Captain R. C. Marshall.

Committee { Mr. W. S. E. Barnardo. Professor H. R. Briton-Jones. Professor E. E. Cheesman. Professor R. C. Wood. Mr. O. J. Voelcker.

Hon. Secretary. .Mr. G. Wright.

On Wednesday, 16th November, a visit was paid to the St. Clair Experiment Station where there was a demonstration of budding and grafting in general, also the pruning of coffee. A complete discussion took place on the lime industry, its threatened destruction by Withertip disease (*Gleosporium*), and the steps taken by the Department of Agriculture to meet the situation. Thanks are due to Mr. R. O. Williams who was responsible for the admirable series of demonstrations.

On Wednesday, 23rd November, Valsayn Coconut Estate was visited. Mr. Carrington Smith, the manager, escorted the party round and questions of spacing, treatment of trees and nut selection were discussed. The Professor of Mycology gave some information on diseases of the coconut palm. Later the portion of the estate laid out in grape fruit was visited.

On Wednesday, 14th December, a visit was paid to the Arena Forest Reserve under the guidance of Captain R. C. Marshall, Conservator of Forests for Trinidad. Trial areas were viewed of particular mixed growths planted under variable shade, and then the original forest, the land being cleared for planting, and finally a one-year old block were visited. The whole scheme was made most understandable by leaflets which Captain Marshall kindly provided. Throughout the co-operation of the Agricultural and Forestry Departments was emphasized.

* * *

Professor Ballou was away from the College during November on an official visit as Commissioner of Agriculture to the Northern Islands. The object of this visit was, principally, a discussion of the present situation with regard to West Indian Sea Island cotton which, for several years past, has been produced in greater quantity than it could be absorbed by the trade. At the present time there is a considerable surplus on hand which had been carried over from the 1926 and previous year crops, amounting to some three or four years supply for the market at the rate of consumption which has prevailed for the past few years, and the crops for 1927 from Montserrat and St. Kitts are still unsold. The Fine Spinners' and Doublers' Association, who are the chief purchasers of this cotton, suggest that the West Indian growers should reduce the output by at least 50 per cent. of the average for the past five years. The means by which this reduction can be accomplished, and the crops which might be utilised to take the place of cotton where the reductions were being made, were subjects of consideration during the visit. In several of the islands where cotton has already been planted, a reduction in area has already been made, and, in others, where the planting season begins next March, it is likely that this reduction will be continued. It is suggested also that other types of cotton should be tried with a view to replacing West Indian, entirely or in part, with a cotton which shall be more readily saleable.

TREND OF THE MARKETS.

[*The notes below are based principally upon running charts of the prices of the basic grades and upon general statistical information gleaned from contemporary publications and cablegrams and are intended to be a record of movements. An attempt is made, where possible, to indicate the market outlook at the time of going to press, but no responsibility for the accuracy and subsequent truth of such observations is assumed. Unless otherwise stated the prices quoted are spot, London.*]

SUGAR.—The home market was firm in the middle of November but became easier at the beginning of December. Quotations were as follows : —Raw Centrifugals 15*s*. 10½*d*., for Preferentials, and 12*s*. 6*d*. for Perus. West Indian Crystallised 31*s*. to 33*s*. duty paid with a small business passing. Prices have risen since the beginning of December, quotations on 17th December were as follows : Foreign 96°, *c.i.f.* 13*s*. 3*d*. per cwt., Preferential 17*s*., Yellow Crystals landed duty paid 29*s*. 6*d*. to 33*s*. 6*d*. It is reported that producers in Java have decided not to extend plantings next year and have agreed to work in harmony with Cuba. It is understood that a minimum selling price has been fixed. Messrs. Willet and Gray have published a preliminary estimate of the world's crop for 1927-28, which they place at 24,836,000 tons, consisting of 15,701,000 tons of cane and 9,135,000 tons of beet. The 1926-27 crop amounted to 23,591,000 tons, consisting of 15,901,000 tons of cane and 7,690,000 tons of beet.

* * *

COTTON.—Prices have shown a declining tendency due to persistent long liquidation with small buying power. The Egyptian market has shown a sharp decline on the heavy movement of the Sakel crop. There has been rather more enquiry for West Indian Sea Island cotton, but prices except for extra fine are reduced. Quotations on 1st December for West Indian Sea Island stood at Fair 21*d*., Fine 28*d*., and Extra Fine 40*d*. per lb.

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CACAO.—Trade was not as bright in November as might be expected from past experience, but a fair all-round trade was passed. At the beginning of December the following prices were made : Ceylon 78*s*., 82*s*., 90*s*., and 92*s*. per cwt. ; Trinidad 79*s*., 81*s*., and 83*s*. ; Guayaquil 77*s*., 80*s*., 83*s*., and 95*s*. ; Caracas 125*s*. ; Bahia 70*s*. and 77*s*. ; San Thome 77*s*. and 79*s*. ; and Cameroons 71*s*. and 73*s*., per cwt. Quotations on the 17th December, were as follows :— Trinidad L.L.T. per cwt 66*s*., to 75*s*. ; Grenada 70*s*.

* * *

COFFEE.—The November trade in coffee has been quite good. Prices realized in London per cwt. have included : Costa Rica 130*s*., 150*s*., 155*s*., 160*s*., and 190*s*. ; Other West Indian 105*s*., 120*s*., 125*s*., and 150*s*. ; Colombian 115*s*., 130*s*., and 161*s*., ; Indian 130*s*., 145*s*., and 155*s*. ; Sumatra 90*s*., and 93*s*. ; Jamaica (common) 100*s*., and 105*s*., (mountain) 190*s*., and 200*s*. ; Brazilian 90*s*., 95*s*., and 105*s*. ; Mocha 120*s*., 125*s*., 132*s*., and 158*s*. The Prices of Kenya and other East African vary a great deal, and Abyssinian is scarcely quoted. The Brazilian state support of the coffee industry has so far been successful, the Government loan enabling growers to hold new crops instead of "flooding the market."

* * *

TEA.—The averages for tea include 20·81*d*. Ceylon, 19·84*d*. Indian, 16·68*d*., Java, and the high quality Darjeeling tea is considered cheap at a mean price of 21·33*d*. A large trade is passing in Assam tea.

* * *

RUBBER.—Prices after advancing from 19·53*d*. to 19·77*d*. between 19th and 26th November and reaching 20*d*. on 28th November, closed the month somewhat weakly. The tone for 1928 delivery is improved, as it is thought that buyers in this country must abandon their 1927 attitude of reserve very shortly. In the United States imports since 1st January shows 25,000 tons increase over the previous year's and stocks have risen by 34,000 tons.

* * *

COPRA.—Demand has fallen off for the time being and this makes the position of weak holders difficult. Quotations for West Indian *c.i.f.* per ton on 17th December were £27 15*s*.

SPECIAL CITRUS SURVEY.

MR. H. CLARK POWELL, who is Professor of Horticulture at the Transvaal University College, and is also technical adviser to the South African Citrus Board, has been appointed by the Empire Marketing Board to make a special survey of the citrus-growing countries of the Empire and elsewhere with a view to encouraging the production and marketing of fruit in the Empire.

Mr. Powell will go to Cairo, Palestine, and Cyprus, and will later proceed to England. There he will be for a few months at East Malling, the station in Kent, the headquarters of the research department of the Empire Marketing Board. It is hoped to make this station a central clearing-house for citrus research throughout the Empire—the centre of a vast chain of research stations all over the Empire. From East Malling he will go to British Honduras, Jamaica, Porto Rico, Florida and California, studying all the time questions of production, transportation, marketing, shipping, and labour supply, in their special relation to citrus growing. On his return it is quite likely that he will visit Kenya, Nyasaland, the Gold Coast, Sierra Leone, and Rhodesia. The whole trip will take about a year and a half.—*The African World*.—Vol. C, p. 411.